Software Reliability Measures: Types and Desired Properties

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Current Reliability Measures

- Current product measures in 982 can be divided into two categories
  - Direct measures of reliability
    - Reliability growth function
    - Mean time to failure
    - Residual fault count
  - Reliability surrogates
    - Graph theoretic complexity
    - Design structure
    - Software release readiness

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Direct Measures of Reliability

- Do not rely on measurements of system structure
- Measure observed behavior of system during execution
- Mean the same thing, regardless of type of system being measured
  - Reactive
  - Distributed
  - Hard Real-Time
  - Client-Server
  - ...
- Current 982 measures of this type can be retained with minimal amount of modification

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Reliability Surrogates

- Estimate reliability/fault content based on structural characteristics of the system
- Surrogates should have the following properties
  - Demonstrated relationship between structural measurements and reliability
  - Feasibility
  - "Ease of Interpretation"

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Surrogates - Relationship to Reliability

- To establish relationship between structure and reliability, all aspects of software system's structure need to be measured
  - Traditional structural measurements
  - OO
  - Temporal constraints
  - Interrupt handling structure
  - IPC and task synchronization
  - Exception handling
  - ...

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Surrogates - Measurement Feasibility

- To be useful, surrogates also have to be easily measured in a development environment AND useful to the developers
  - Ideal - measurement process transparent to developers
  - Ideal - measurements at lowest level should aggregate to higher levels
  - Ideal - measurements should feed back in real-time or near real-time to developers:
    - Rapid identification of problem areas
    - Buy-in from developers

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What Should Change?

- Identify surrogate measurements that don't fit the criteria previously set forth. Measures that should be examined include
  - Software Release Readiness - weightings and influence coefficients are subjective; assigning values may be problematic
  - Test Accuracy - relies on fault seeding, which is not a common practice
  - Software Maturity Index - better methods of measuring change exist
- Add measurements that have been shown to be effective in estimating reliability/fault content
  - Proportional fault change/cumulative fault burden - based on PCA of measurements of structural evolution. Versions for O-O systems and design components needed.
  - ...

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